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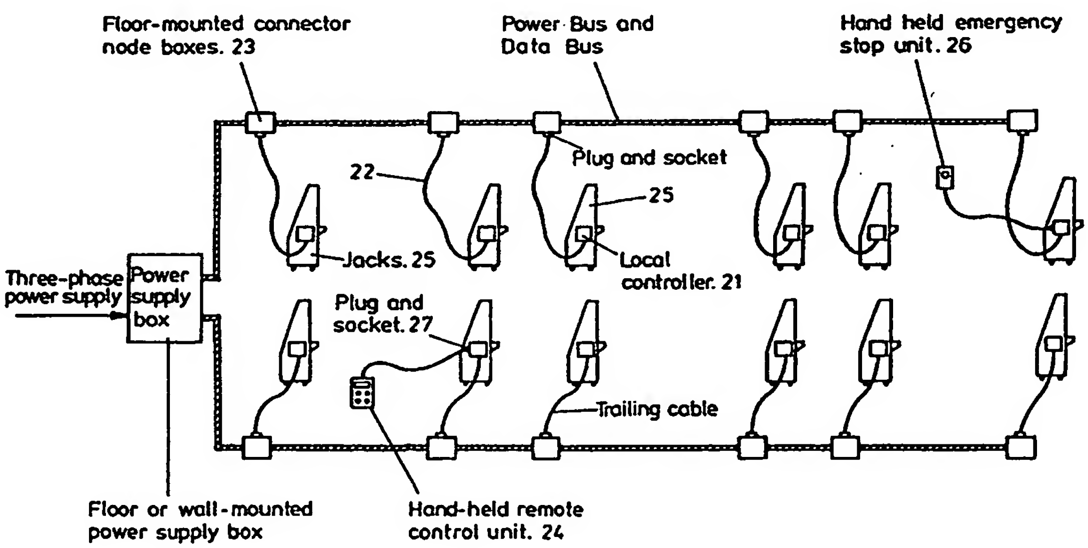

(57) Abstract

The invention relates to a multipoint control system such as may be used for controlling lifting jacks for lifting whole railway cars at a time. Particular features of the present invention are that a remote controller (24) is provided in a hand–held remote control unit. Local controllers (21) are provided associated with jacks (25). Each local controller (21) is an intelligent controller and has a plug and socket arrangement to which the remote controller (24) may be attached. In such a way, the remote controller (24) may be plugged in at any part of the network to control and synchronise operations of all of the jacks (25). Local controllers are all interlinked by a serial data link network which cuts down dramatically on the wiring required. A further distinctive feature of the system is that it is fail safe so that if communication between any of the elements should break down or if any element malfunctions, the system will automatically bring itself to a halt.

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MULTIPOINT CONTROL SYSTEM

The invention relates to a multipoint control system. Particularly, but not exclusively, the invention relates to such a system for controlling items such as lifting jacks for lifting whole railway cars at a time.

Whenever maintenance is desired to be carried out to elements on the underside of a train or a rail coach, that train or rail coach needs to be lifted so that the inspection can take place. Typically, the lifting takes place in specialised workshops whereby four jacks are required, one at each corner, to lift each rail coach. It is most important when carrying out a lifting operation, or a lowering operation, that all the jacks operate in harmony as, if one jack raises too quickly relative to the others then there is an imbalance which could be potentially disastrous. In the earliest systems, a man needed to be provided for each jack and raising and lowering was a complicated affair since each operative needed to shout to his fellow operatives as to when the raising/lowering was taking place and by how much.

In more recent times, automated systems have been proposed whereby each jack can be controlled by a central controller utilising a remote cabinet with trailing cables to the individual jack units. However, to implement such a system, especially where more than one coach is to be raised at a time, the necessary wiring from the controller becomes very expensive and cumbersome since individual power and control leads need to be supplied to each jack. In some applications it could be required to lift as many as twelve or more railway coaches at a time and in such cases, the wiring outlay is particularly expensive and cumbersome. Also, the synchronization of operation of

such multiple numbers of jacks becomes increasingly difficult which poses further safety problems.

It is an aim of embodiments of the invention to provide a multipoint control system having a reduced wiring outlay.

Another problem with prior art systems is that when a fault develops, the system controller can sometimes have difficulty in pinpointing the fault and ensuring that, for instance, if the fault is related to a jack not raising or lowering when commanded to, other elements in the system do not carry on with their normal operations until the fault has been dealt with.

According to a first aspect of the invention, there is provided a multipoint control system comprising a remote controller and a plurality of local controllers, each local controller being connected to a common system bus, the remote controller being arranged to broadcast instructions to selected groups of said local controllers and to receive status information from said local controllers.

In preferred embodiments, the remote controller and local controllers communicate via a serial data link.

Preferably, if communication between the remote controller and a local controller from a selected group fails then an emergency stop is performed.

Preferably, each local controller is arranged to control a sub-system.

Preferably, the local controllers are arranged to broadcast selected data to the master controller and other selected local controllers.

Preferably, if any local controller fails to receive instructions or data from the system bus within a given time period then that local controller will perform an emergency stop.

Preferably, each local controller which receives a broadcast signal is arranged to respond to the remote controller.

Preferably, if any selected local controller fails to respond to the remote controller within a predetermined period, then the remote controller is arranged to perform an emergency stop.

Preferably, the signals transmitted on the system bus comprise binary signals which, when the bus is active, manifest themselves as pulses.

Preferably, each of the local controllers is adapted to receive the pulses from the system bus and, if any local controller fails to receive such a pulsing signal then that local controller will electrically disconnect at least one component which it controls from the system until such time as the pulsing signal is being received properly.

The component may be a sub-system.

Preferably, if signals are being received from the system bus by any particular local controller then that

local controller is arranged to internally generate a continuously toggling signal.

Preferably, each local controller includes a capacitor network whereby the toggling signal serves to maintain a given voltage at an output of the capacitor network, so that if the toggling signal is not generated, the output of the capacitor network will decay. Preferably, the local controllers rely upon their toggling signal to provide electrical power and if it is not generated by a given local controller then sub-systems under the control of that local controller are automatically disconnected from their power source.

Preferably, each local controller is provided with output means such that if the voltage from the capacitor network decays beyond a certain level, the output means is operative to perform an emergency stop operation.

The output means may comprise a relay, whereby the capacitor network provides an energising voltage.

Preferably, each local controller is provided with an input to which the remote controller may be connected, such that the remote controller may be connected to any local controller within the system.

Preferably, the remote controller is configurable in both a local mode in which communication with only the particular local controller to which it is directly connected is enabled and a remote mode in which communication from and to the remote controller is made with each selected local controller.

Preferably, the system bus comprises a 2-wire link in a "twisted pair" type configuration. Transformer coupling may be utilised to connect individual local controllers and the master controller to the system bus.

Alternatively, a fibre optic link may be provided.

Preferably, the status information includes information necessary for synchronisation of operation of sub-systems of the local controllers.

In preferred embodiments, the sub-systems comprise jacks and the information necessary for synchronisation includes height information concerning a given height which has been reached by a jack associated with each local controller.

Preferably, each of the local controllers controls a dedicated jack and each local controller is arranged to broadcast the height information.

Broadcast height information from one local controller is preferably received at each other selected local controller and a local comparison made between the received broadcast height information and the local height information.

Preferably, if received broadcast height information and the local height information differs by more than a predetermined amount, the local controller having made that comparison sends a message to the remote controller.

The remote controller may be adapted to compare height information received from the local controllers and perform a synchronisation operation.

In a preferred embodiment, the multipoint control system is adapted to control lifting by means of jacks. Preferably, the system is adapted to lift one or more cars of a train. Preferably, in such a system, each local controller is dedicated to a single jack and a group of four jacks is required to lift each car.

According to a second aspect of the invention, there is provided a system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups and each sub-system within any given selected group is required to perform the same task, at substantially the same time, within predetermined tolerance limits, the system being particularly characterised in that, if any sub-system within any of said selected groups exceeds said tolerance limits, an emergency stop will be performed.

According to a third aspect of the invention, there is provided a system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups, the system being particularly characterised in that, the system comprises a remote controller and each of said sub-systems includes a local controller whereby the remote controller issues commands to each of the local controllers of the selected groups and if any of said local controllers fails to respond, an emergency stop is performed.

According to a fourth aspect of the invention, there is provided a system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups, the system being particularly characterised in that, the system comprises a remote controller and each of said sub-systems includes a local

controller whereby the local controllers and the master share a common serial data link.

Preferably, the remote controller is connectable to the serial data link by plugging in the remote controller at any of said sub-stations.

According to a fifth aspect of the invention, there is provided a system for controlling a plurality of groups of jacks, wherein any given selected group of jacks is required to raise or lower an object by a user specified amount, the system being characterised in that each jack is provided with a local controller for receiving instructions from a remote controller and whereby each local controller and the remote controller are linked by a serial data link.

The second to fifth aspects of the invention may be combined with any of the features of the first aspect.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 shows a conventional multijack control system;

Figure 2 is an overview of a system in accordance with a preferred embodiment of the present invention;

Figure 3 is an illustration of a front panel for a remote controller for use with the system of Figure 2;

Figure 4 is a schematic diagram for a floor mounting box of the system of Figure 2; and

Figure 5 is a schematic diagram showing a local control panel of a jack for the system of Figure 2.

Referring to Figure 1, there is shown a conventional multi-jack control system having a local control panel 1 on each jack. Each local control panel 1 is connected to the system by plugging in an eighteen core flexible trailing cable 2 into a floor mounted connector node box 3. The floor connector boxes 3 are connected to a main distribution box 4 by means of a fixed underfloor installation of separate power and multicore signal cables 7. In the case of a twelve jack system as shown, this requires thirty six separate under-floor cables of a total length of perhaps 1,500 meters and containing 216 individual cores. The main distribution box 4 is generally situated at one end of the system and has the underfloor cables connected to it, as well as having a plurality of multi-way connectors for connection of remote control panel trailing cables to connect the distribution box 4 to a remote control panel (not shown). The number of cores in the trailing cables is at least 70.

The under-floor cable installation is a major portion of the control system cost. The main control panel position is limited to one position on the installation, usually in the middle of the train, but sometimes at one end. Information provided to an operator is limited. For instance, if an emergency stop button is pressed on one of the jacks 5, by way of a hand-held emergency stop unit 6 (only one of which is shown, but which are provided for all jacks 5) then the operator does not know which one.

A walk of up to 150 meters is required to check all the buttons.

Figure 2 is an overview of a system in accordance with a preferred embodiment of the present invention. In the system of Figure 2, local controllers 21 are provided associated with jacks 25 to form a plurality of sub-systems. Each of the local controllers 21 is provided with electronic intelligence and all controllers are linked together by means of a serial multidrop network. The remote control panel of the main distribution box 4 of the Figure 1 system is replaced by a hand-held remote control unit 24 which is an intelligent controller which can be plugged into any of the local controllers 21 by means of a plug and socket link 27 - thereby enabling a single operator to control the whole system, or selected jacks, from any appropriate position.

Trailing cables 22 are still utilised to join local controllers 21 of each jack 25 to floor mounted boxes 23. However, the cabling installation is significantly reduced. All that is required is a multicore signal cable with a much reduced number of cores (11 in the illustrations) and a four core power cable. The underfloor installation is also reduced in the same manner, there is now only required a two cable link between adjacent under floor boxes, that two cable link being a four core power cable and a two core system signal bus. Individual local controllers 21 and the remote controller 24 are connected to the system signal bus via transformer type coupling and the two core wiring of the system bus are in a "twisted pair" configuration to provide good noise immunity. Reducing the system bus to a 2-wire connection is possible since the signal structure carried by it and the intelligence of the local

controllers 21 enable each local controller to receive and interpret instructions from the remote controller 24 and to provide serial information back to the remote controller 24.

Because there are only four power cores and a twisted pair connection for the system bus (the 2-cores of the twisted pair being interchangeably connectable) in the whole under-floor system, those cores can all be colour coded and the need for wire and terminal numbering which was previously present with the system of Figure 1 is eliminated resulting in a system for which it is much easier to track down wiring faults.

Each jack is connected to a central control ring via twisted pair type signal connections. Each jack has its own address which is set at the floor mounting boxes 23. There is a two bit jack address and a four bit car address. There is also provided an even parity bit.

Figure 4 shows the basic layout at a floor mounted box with the system bus comprising a local control network bus LON bus 40 consisting of control lines 41 and 42 (being the above-mentioned "twisted-pair") being provided at an input end of a PCB 44 for the floor box 23, the same connections 41 and 42 being provided at an output end of the PCB 44. A three phase power connection with earthing point being provided by a power bus 45. Address switching is made via DIP type switches on the PCB 44, a first four bit DIP switch 46 being provided for setting car address and a second three-bit DIP switch 47 being provided for setting jack address and parity bit. The floor boxes 23 are linked to the local controllers by a trailing cable 22 comprising a four core local power bus 48A, a two wire LON BUS IN 48B connection, a two wire LON BUS OUT connection

48C, and an address connection 48D. It will be appreciated that the system bus (LON BUS 40) comprises a continuous ring, and that the schematic connections to the system bus shown in the Figure are the connections utilised at each local controller to join to that ring. In other words, it should be understood that the removal of a given local controller from the system would not leave a "gap" in the ring.

As mentioned previously, the hand held remote control unit 24 may be plugged into any one of the local controllers 21. The controller 24 may send messages via the two core system bus cable to any selected group of jacks, so as to control one or more up to all of the jacks at the same time. Which ones of the jacks are being selected is determined by an address sent out by the controller as will be described later.

An important feature of the present invention is that any serial messages being sent on the system bus, which messages are made up of ones and zeroes, will cause a pulsing broadcast message signal along lines 41, 42, which are, as mentioned above, connected in multidrop fashion to all jacks. Correct operation of the jacks is conditional upon proper receipt of a message signal. If any one or more of the jacks are not periodically receiving such a pulsing signal from the system bus then this means that messages are not being received. A safety feature of the system is that, those jacks which do not detect activity on the system bus are arranged to automatically cut themselves off from the system by opening power supply relays. Further, the controller 24 is arranged to note those jacks which are not responding and take appropriate action, such as shutting down the whole system if necessary.

Figure 5 shows the internal structure of the local controllers 21 of the jacks 25. Each local controller receives the signals output by the local power bus 48a, LON bus in 48b, LON bus out 48c and address connection 48d via trailing cables 22 from the floor mounted node boxes 23.

The power bus 48a is connected firstly to a step down transformer 51 for supplying a reduced voltage supply to a local control PCB 52 of the local controller 21 and to supply power outputs to the jack via enable contactors 53E, lower contactors 53L and raise contactors 53R. The three contactors 53E, 53L and 53R are controlled by outputs E, L and R of the local control PCB 52. The PCB 52 also has connections for an emergency stop buttcn E. Connections 57 for an array of external sensors for detecting conditions such as nut wear, up and down movement, possible obstructions, on load condition and on stand condition are provided. Input LON in is also provided on the PCB for connection to bus 48B, input LON out is provided for connection to bus 48C and input position address is provided for connection to address bus 48D.

Individual push buttons are provided attached to the local control PCB for providing a manual raise/lower function and a lamp test via connections 54, indicator lamps are provided via connections 55 and connections to allows the plugging in of the hand held remote control unit 24 are provided at connection 56.

Figure 3 shows a front panel of the hand-held remote control unit 24. The front panel includes menu up 31 and menu down 32 buttons. An enter key 33, mute alarm 34 and raise/lower buttons 35, 36. It also includes a three-way

key switch 37 for designating off, local and remote operation. Local operation is used to allow the controller to be plugged into any jack so as to set an initial height of that jack, for instance. Remote operation is for the selection and control of any one or more groups of jacks as required. Raising and lowering of cars always involves the activation of a group of four jacks per car, therefore during operation there is always a need for each jack of any given group to work in concert with the other jacks of that group.

There is also provided a key pad 38 whereby one or more cars of a train which are desired to be lifted may be keyed in to effectively select jack groups. There is also a display 39 for displaying menu items and status information. The display 39 is typically a four line by sixteen character LCD display. Menu functions which can be displayed may include twelve functions, nominally referred to as OPERATING, SELECT CARS, FAULTS, EMERGENCY STOPS, ON-LOAD, ON STANDS, CONNECTED, OBSTRUCTED, OVERLOAD, NUT WEAR, HI LIMIT and LOW LIMIT.

The various abovementioned menu labels correspond to the following functions:

<u>Operating</u>

Indicates that the system is raising or lowering jacks with no problems.

<u>Select Cars</u>

This menu function allows the selection of cars by using the keypad 38 and shows those cars which are selected. As noted previously each car C1 to C12 corresponds to a group of four jacks, since four jacks are needed to raise or lower each car and since each group of

4 jacks needs to operate in unison, only one button is needed to designate any group of 4.

Faults

When this function is selected, the memory shows any faults which have been registered.

Emergency Stops

If any of the emergency stop buttons 26 (of Figure 2) have been activated this menu function will reveal which emergency stops are concerned. Although Figure 2 only shows one hand held emergency stop unit, it will be appreciated that all of the jacks 25 have an emergency stop unit associated with them.

On Load

Indicates the condition where a jack has been put under the lifting point and raised until it is just supporting a corner of the car.

On Stands

This menu function is a provision whereby a group of cars can be lifted and the car bodies supported on fixed stands. When the bodies are supported n this way, the remote controller is informed and the jacks may then be re-employed for lowering any one or more bogie from the car.

Connected

This function shows which local controllers the remote controller 24 recognises as being connected to the system and communicating with it.

Obstructed

This function shows whether a given jack has encountered an obstructing object under its' shoe whilst lowering.

Overload

This menu function shows any jacks which are being overloaded.

Nut Wear

This menu function shows any jacks which have a worn nut configuration and may need replacing. Each jack is provided with a "nut wear" sensor.

Hi Limit

This menu function reveals the upper limit set for raising the jacks.

Low Limit

This menu function shows the bottom limit for lowering the jacks.

There will now be described the means by which messaging and function commands take place in REMOTE mode between the remote controller and the individual local controllers 21 by means of the LON bus 40.

The network message protocol is organised to ensure operational safety to give a failsafe type of operation. In order to ensure operational safety it must also enable synchronization of jack heights during lifting and lowering.

Failsafe

The fail safe features are ensured by means of a fixed master/slave message protocol. The master is the

remote controller and each of the jacks are slaves. Each slave has a unique address which is determined by the node box into which it is plugged, as described in association with Figure 4. To ensure failsafe operation, the following message sequence is performed repetitively.

Firstly, the remote controller 24 which is plugged into any of the jacks 25 by plug and socket arrangement 27 sends a broadcast message via the LON BUS to all of the jacks. The message contains a system function command element and a jack "status request" element. Each jack which receives the message complies with the command and sends a reply to the remote controller. The message contains an element describing the jacks' status and measured height.

When either all the replies have been received or a preset time period has elapsed, the remote controller sends the next broadcast message. If any one of the jacks has not replied to at least one of the broadcast messages within the preset time period, then this next command issued by the master will be an emergency stop. If any one of the jacks has replied with an emergency stop status, then the broadcast command will also be emergency stop. If the height difference between any two of the jacks exceeds a preset value then the broadcast command will be emergency stop.

Each jack which receives the message will comply with the command and send a status reply to the remote controller. Any jack which has not received a message from the remote controller within a preset time period will perform an emergency stop itself, as previously described.

In the above way, if any abnormalities are detected by the remote controller or if a reply is expected but not received within a given time then the remote controller triggers an emergency stop, whereas if any jack which was expecting a broadcast message from the remote controller does not receive it then that jack will itself perform an emergency stop. In this way, the system is designed to be completely failsafe.

One particularly inventive feature which contributes to the failsafe nature of the operation is that the issuance of broadcast messages from remote controller 24 (the master), is detected by all properly operating local controllers 21 and those local controllers are thereby triggered to provide an internally toggling signal to power a safety relay. Each time bus activity is detected at the local controller 21 the output to the safety relay toggles. If messages on the bus are detected within predetermined time constraints then the safety relay closes and remains closed. The safety relay may have a hardware construction based on a capacitor network such that if a regularly toggling input is not provided the voltage held by the network will decay and the relay will trip to physically shut the power off at a local level (i.e. perform an emergency stop).

Synchronization

To ensure adequate synchronization of all the jacks a height adjustment procedure is adopted. The measured height of each jack is sensed locally via appropriate sensor inputs among array 57, and output to the LON bus 40. Each local controller 21 monitors the LON BUS 40 so that the height information of jacks transmitted on the LON BUS 40 is continuously compared at a local level with the height of the jack of the comparing local controller.

If the local controller finds that the height difference between any of the other jacks 25 and its' jack exceeds a preset level then it sends a message to the remote controller 24.

If the remote controller 24 is alerted by one of the local controllers 21 that there is a height discrepancy then a re-synchronisation operation is performed as follows.

Firstly, the remote controller sends a broadcast message to all of the jacks. The message contains the function element "go to required height and stop". The "status request" element is included as before.

Subsequently, each jack which receives the message calculates what the required height should be, complies with the command and sends a reply to the remote controller. The reply message contains an element describing the jacks' "status" and "measured height". Any jack which has not received a message from the remote controller within a preset time period will "emergency stop" itself.

Next, the remote controller sends a broadcast message to all of the jacks.

(i) If all the jacks are not stopped at the required height then: the message contains the function element "go to the required height and stop". The "status request element" is included as before.

(ii) If all the jacks are stopped at the required height then the normal message content is resumed.

(iii) If any one of the jacks has not replied to at least one of the broadcast messages within the preset time period, then the command will be "emergency stop".

(iv) If any one of the jacks has replied with emergency stop status, then the broadcast command will be "emergency stop".

(v) If the height difference between any two of the jacks exceeds the preset value then the broadcast command will be "emergency stop".

In the above manner, if all of the jacks and remote controller are functioning correctly, the jacks will proceed to raise or lower in steps. The required size of the steps and how they are reached is stored in local memory of each of the local controller PCB's 52, and it is this information which, together with information on the current height provides basis for the "required height". Whilst raising or lowering is performed stepwise, the system works so quickly that, in fact, when the system is working correctly it functions in a practically seamless fashion.

It will be appreciated by a man skilled in the art that the abovedescribed system has a large number of advantages over prior systems.

Firstly, the underfloor cable installation is significantly reduced, a two cable link between adjacent under floor boxes being all that is required, one of those cables being a four core power cable and the other a twisted pair system control bus.

The wiring is dramatically simplified, since there are only six different cores in the whole system they can all be colour coded and the need for wire and terminal numbering is eliminated.

Jack trailing cable sizes are significantly reduced and those for the remote controller are eliminated and replaced by a small data cable.

The whole train or separate cars can be controlled from any jack position, an operator being able to wander from jack to jack with the remote controller.

The keypad and display of the remote controller give the operator complete information on the status of all of the jacks.

The system is completely failsafe with automatic synchronization of jack movement.

The system can allow for further expansion with no difficulty as long as the power capacity is adequate. Additional jacks can be linked onto the system and the remote controller sense their presence automatically.

Although the system has been described as being for particular use with jacking systems, it will be appreciated that the general principles described may find application in many other fields, whereby each local controller controls a dedicated sub-system which might, for instance, be an elevating platform system.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and

which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A multipoint control system comprising a remote controller and a plurality of local controllers, each local controller being connected to a common system bus, the remote controller being arranged to broadcast instructions to selected groups of said local controllers and to receive status information from said local controllers.

2. A system according to claim 1, wherein if communication between the remote controller and a local controller from a selected group fails then an emergency stop is performed.

3. A system according to claim 1 or 2, wherein the remote controller and local controllers communicate via a serial data link.

4. A system according to any of the preceding claims, wherein each local controller is arranged to control a sub-system.

5. A system according to any of the preceding claims, wherein the local controllers are arranged to broadcast selected data to the master controller and other selected local controllers.

6. A system according to any of the preceding claims, wherein if any local controller fails to receive instructions or data from the system bus within a given time period then that local controller will perform an emergency stop.

7. A system according to any of the preceding claims, wherein each local controller which receives a broadcast signal is arranged to respond to the remote controller.

8. A system according to claim 7, wherein if any selected local controller fails to respond to the remote controller within a predetermined period, then the remote controller is arranged to perform an emergency stop.

9. A system according to any of claims 5 to 8, wherein signals transmitted on the system bus comprise binary signals which, when the bus is active, manifest themselves as pulses.

10. A system according to claim 9, wherein each of the local controllers is adapted to receive the pulses from the system bus and, if any local controller fails to receive such a pulsing signal then that local controller will electrically disconnect at least one component which it controls from the system until such time as the pulsing signal is being received properly.

11. A system according to claim 10, wherein the component is a sub-system.

12. A system according to claim 9, 10 or 11, wherein if signals are being received correctly from the system bus by any particular local controller, then that local controller is arranged to internally generate a continuously toggling signal.

13. A system according to claim 12, wherein each local controller includes a capacitor network whereby the toggling signal serves to maintain a given voltage at an output of the capacitor network, so that if the toggling

signal is not generated, the output of the capacitor network will decay.

14. A system according to any of claims 12 or 13, wherein the local controllers rely upon their toggling signal to provide electrical power and if it is not generated by a given local controller then sub-systems under the control of that local controller are automatically disconnected from their power source.

15. A system according to claim 12, 13 or 14, wherein each local controller is provided with output means such that if the voltage from the capacitor network decays beyond a certain level, the output means is operative to perform an emergency stop operation.

16. A system according to claim 15, wherein the output means comprises a relay, whereby the capacitor network provides an energising voltage.

17. A system according to any of the preceding claims, wherein each local controller is provided with an input to which the remote controller may be connected, such that the remote controller may be connected to any local controller within the system.

18. A system according to claim 17, wherein the remote controller is configurable in both a local mode in which communication with only the particular local controller to which it is directly connected is enabled and a remote mode in which communication from and to the remote controller is made with each selected local controller.

19. A system according to any of the preceding claims, wherein the system bus comprises 2-wires in a "twisted pair" type configuration.

20. A system according to claim 19, wherein transformer coupling is utilised to connect individual local controllers and the remote controller to the system bus.

21. A system according to claim 3, or any of claims 4 to 18, as appendant thereto, wherein a fibre optic link is provided.

22. A system according to any of the preceding claims, wherein the status information includes information necessary for synchronisation of operation of sub-systems of the local controllers.

23. A system according to claim 22, wherein the sub-systems comprise jacks and the information necessary for synchronisation includes height information concerning a given height which has been reached by a jack associated with each local controller.

24. A system according to claim 23, wherein each of the local controllers controls a dedicated jack and each local controller is arranged to broadcast the height information.

25. A system according to claim 24, wherein broadcast height information from one local controller is received at each other selected local controller and a local comparison made between the broadcast height information and the local height information.

26. A system according to claim 25, wherein if the received broadcast height information and the local height information differs by more than a predetermined amount, the local controller having made that comparison sends a message to the remote controller.

27. A system according to claim 23, where each of the local controllers controls a dedicated jack and the remote controller is adapted to compare height information from each of the local controllers.

28. A system according to any of the preceding claims, wherein the multipoint control system is adapted to control lifting by means of jacks.

29. A system according to claim 28, wherein the system is adapted to lift one or more cars of a train.

30. A system according to claim 29, wherein each local controller is dedicated to a single jack and a group of four jacks is required to lift each car.

31. A multipoint control system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups and each sub-system within any given selected group is required to perform the same task, at substantially the same time, within predetermined tolerance limits, the system being particularly characterised in that, if any sub-system within any of said selected groups exceeds said tolerance limits, an emergency stop will be performed.

32. A multipoint control system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups, the system

being particularly characterised in that, the system comprises a remote controller and each of said sub-systems includes a local controller whereby the remote controller issues commands to each of the local controllers of the selected groups and if any of said local controllers fails to respond, an emergency stop is performed.

33. A multipoint control system for controlling a plurality of sub-systems in which said plurality of sub-systems are divided into a number of groups, the system being particularly characterised in that, the system comprises a remote controller and each of said sub-systems includes a local controller whereby the local controllers and the master share a common serial data link.

34. A system according to claim 33, wherein the remote controller is connectable to the serial data link by plugging in the remote controller at any of said sub-systems.

35. A multipoint control system for controlling a plurality of groups of jacks, wherein any given selected group of jacks is required to raise or lower an object by a user specified amount, the system being characterised in that each jack is provided with a local controller for receiving instructions from a remote controller and whereby each local controller and the remote controller are linked by a serial data link.

36. A multipoint control system substantially as herein described, with reference to Figures 2 to 6.

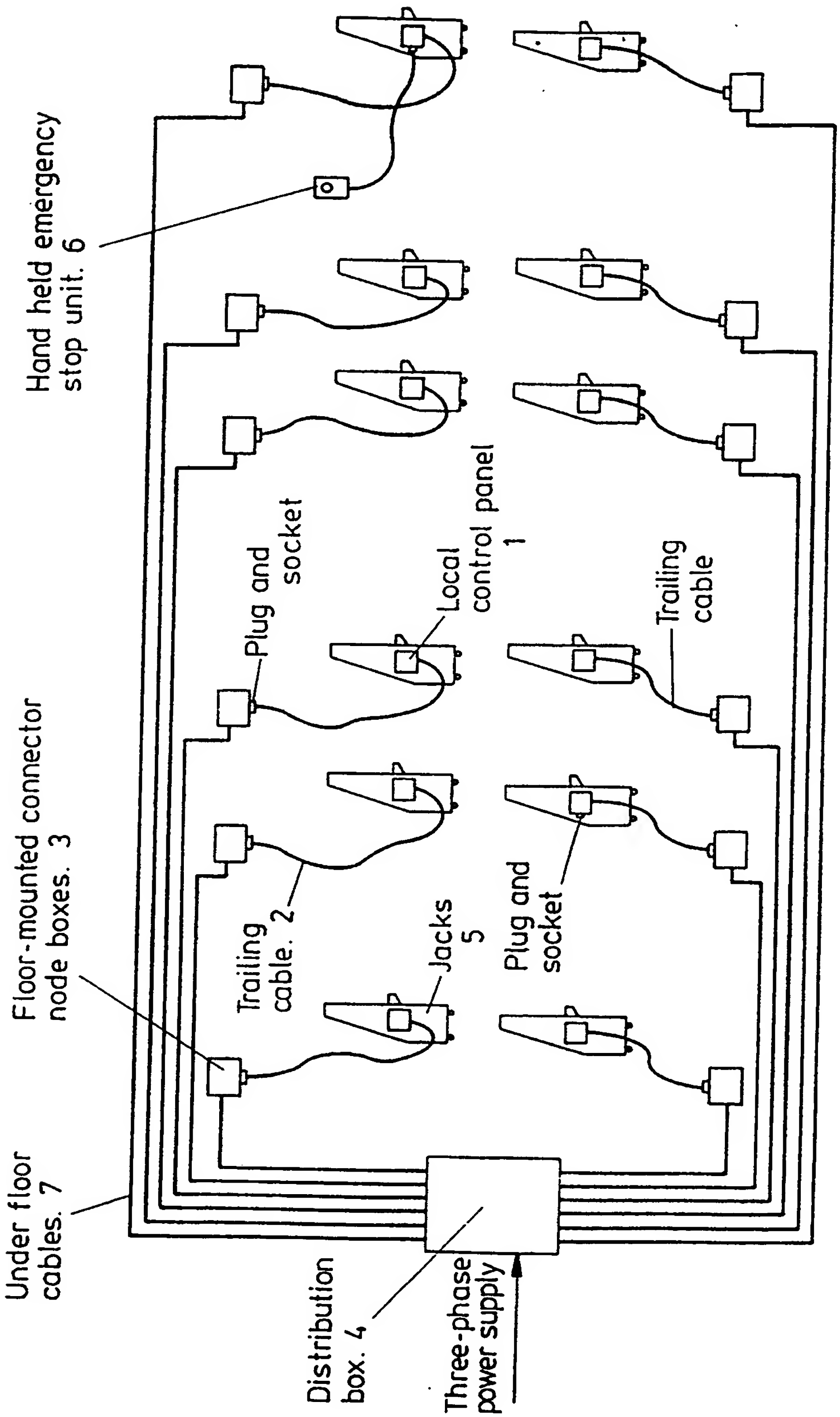
Hand held emergency stop unit. 6
Floor-mounted connector node boxes. 3
Under floor cables. 7
Plug and socket
Local control panel 1
Trailing cable
Trailing cable. 2
Jacks 5
Plug and socket
Distribution box. 4
Three-phase power supply

FIG. 1

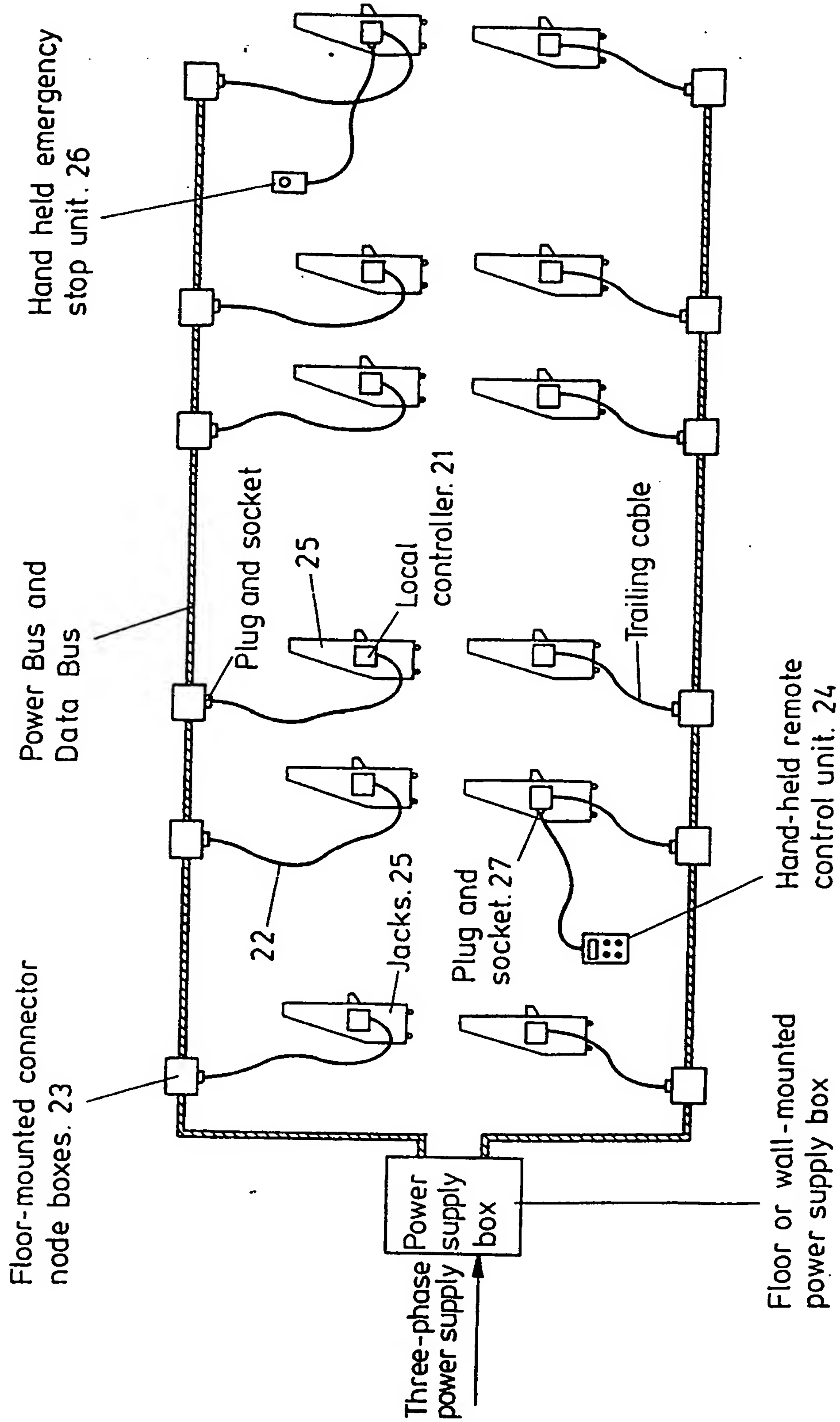
Hand held emergency stop unit. 26
Power Bus and Data Bus
Plug and socket
25
Local controller. 21
Trailing cable
Floor-mounted connector node boxes. 23
22
Jacks. 25
Plug and socket. 27
Hand-held remote control unit. 24
Power supply box
Three-phase power supply
Floor or wall-mounted power supply box

FIG. 2

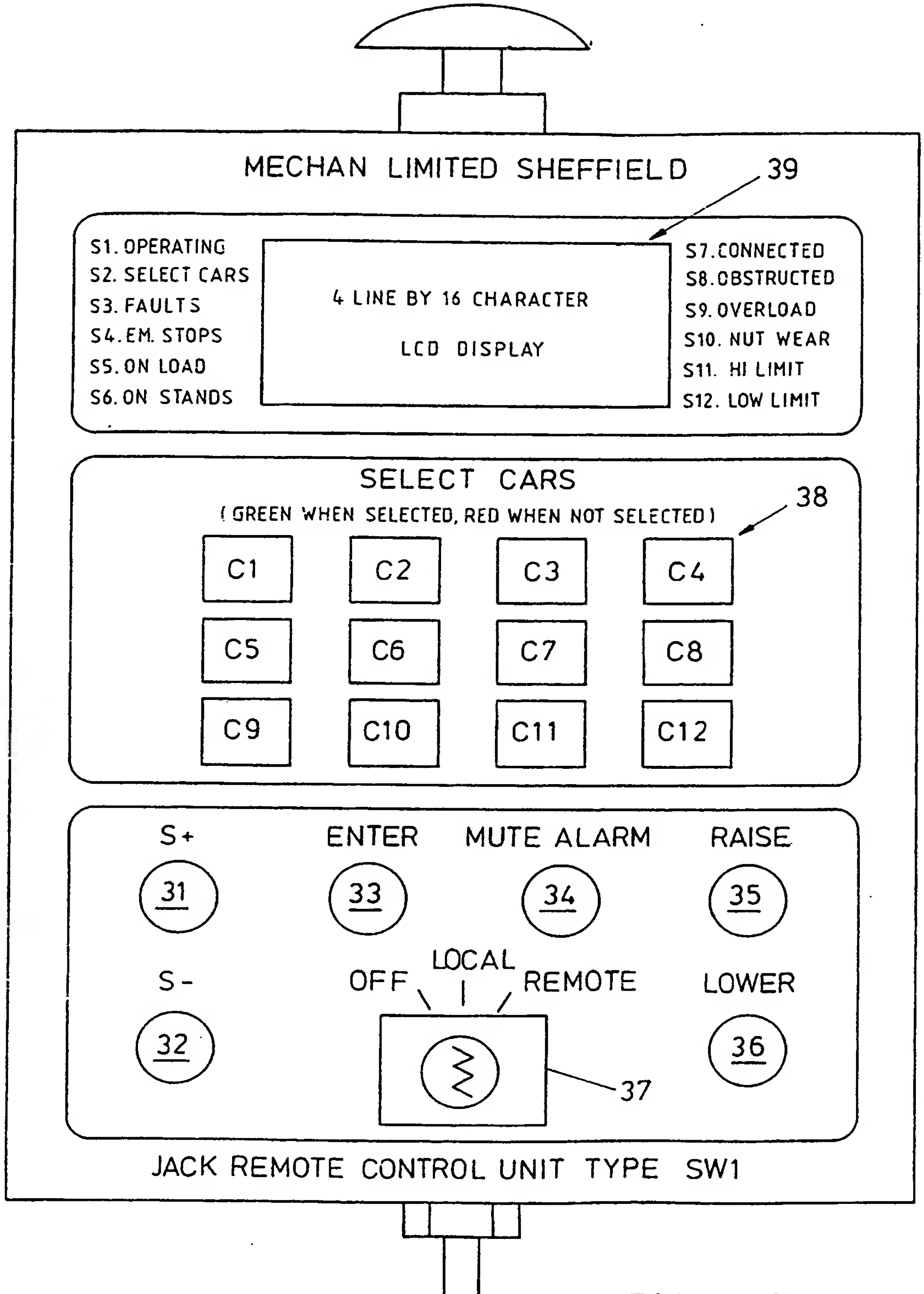
MECHAN LIMITED SHEFFIELD
39
S1. OPERATING
S2. SELECT CARS
S3. FAULTS
S4. EM. STOPS
S5. ON LOAD
S6. ON STANDS
4 LINE BY 16 CHARACTER
LCD DISPLAY
S7. CONNECTED
S8. OBSTRUCTED
S9. OVERLOAD
S10. NUT WEAR
S11. HI LIMIT
S12. LOW LIMIT
SELECT CARS
(GREEN WHEN SELECTED, RED WHEN NOT SELECTED)
38
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
S+
31
ENTER
33
MUTE ALARM
34
RAISE
35
S-
32
OFF
LOCAL
REMOTE
37
LOWER
36
JACK REMOTE CONTROL UNIT TYPE SW1

FIG. 3

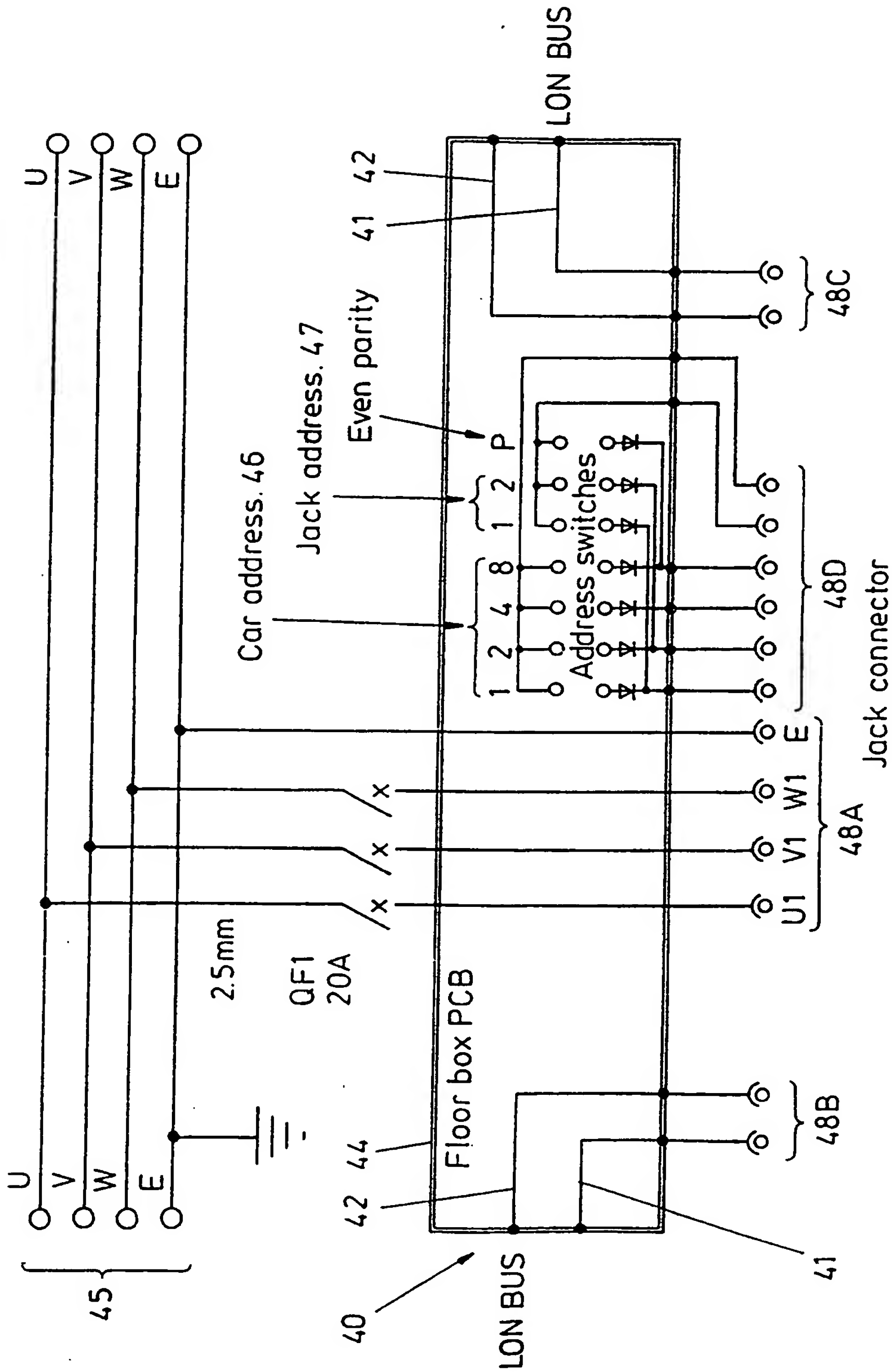
LON BUS
42
41
48C
Car address. 46
Jack address. 47
Even parity
P
1 2
1 2 4 8
Address switches
48D
Jack connector
E
W1
V1
U1
48A
U
V
W
E
2.5mm
QF1
20A
Floor box PCB
48B
44
42
41
40
LON BUS
45

FIG. 4

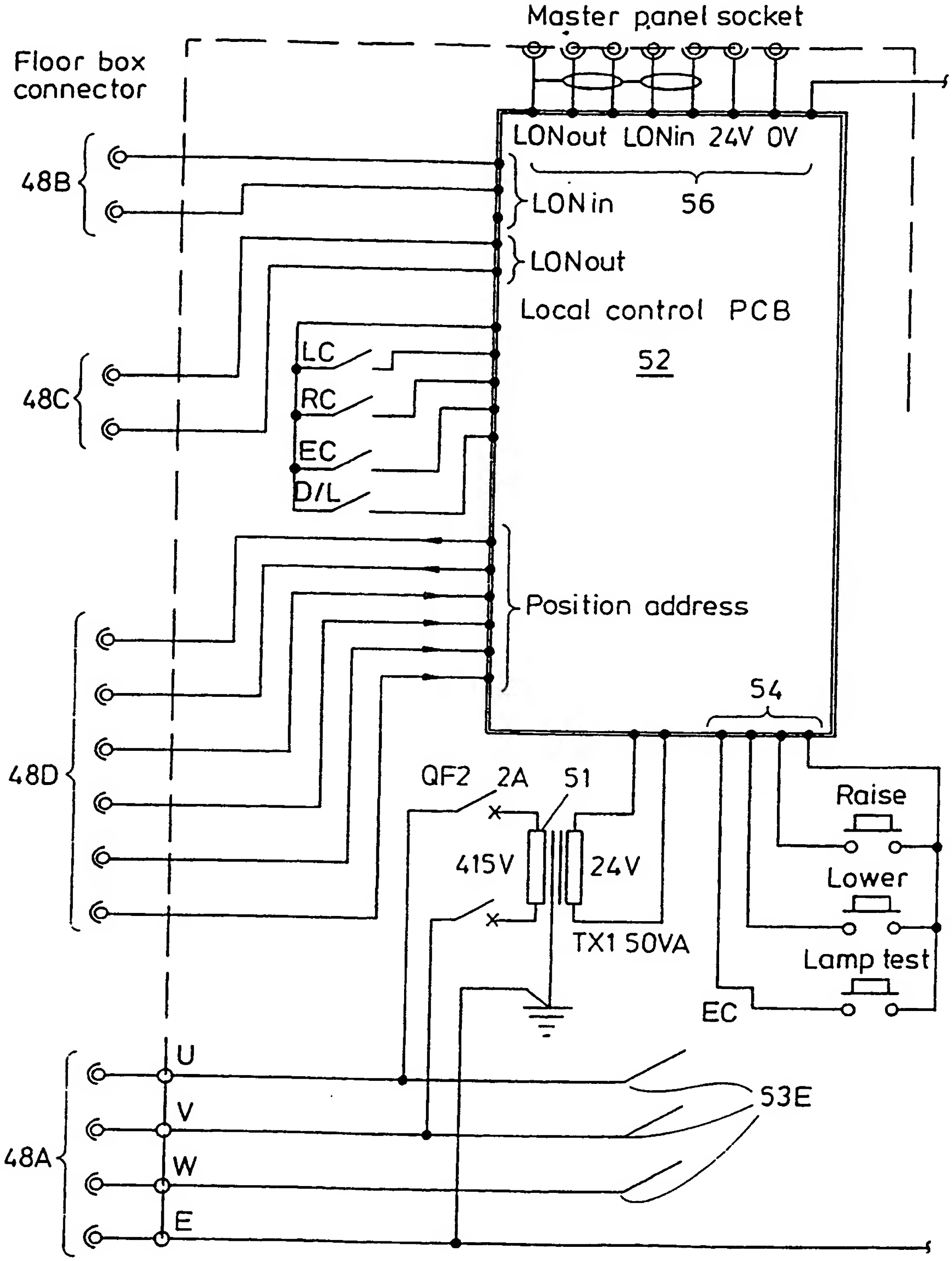
Master panel socket
Floor box connector
48B
LONout LONin 24V 0V
LONin
56
LONout
Local control PCB
52
LC
RC
EC
D/L
48C
Position address
48D
54
QF2 2A
51
415V
24V
TX1 50VA
Raise
Lower
Lamp test
EC
U
V
W
E
48A
53E

FIG. 5

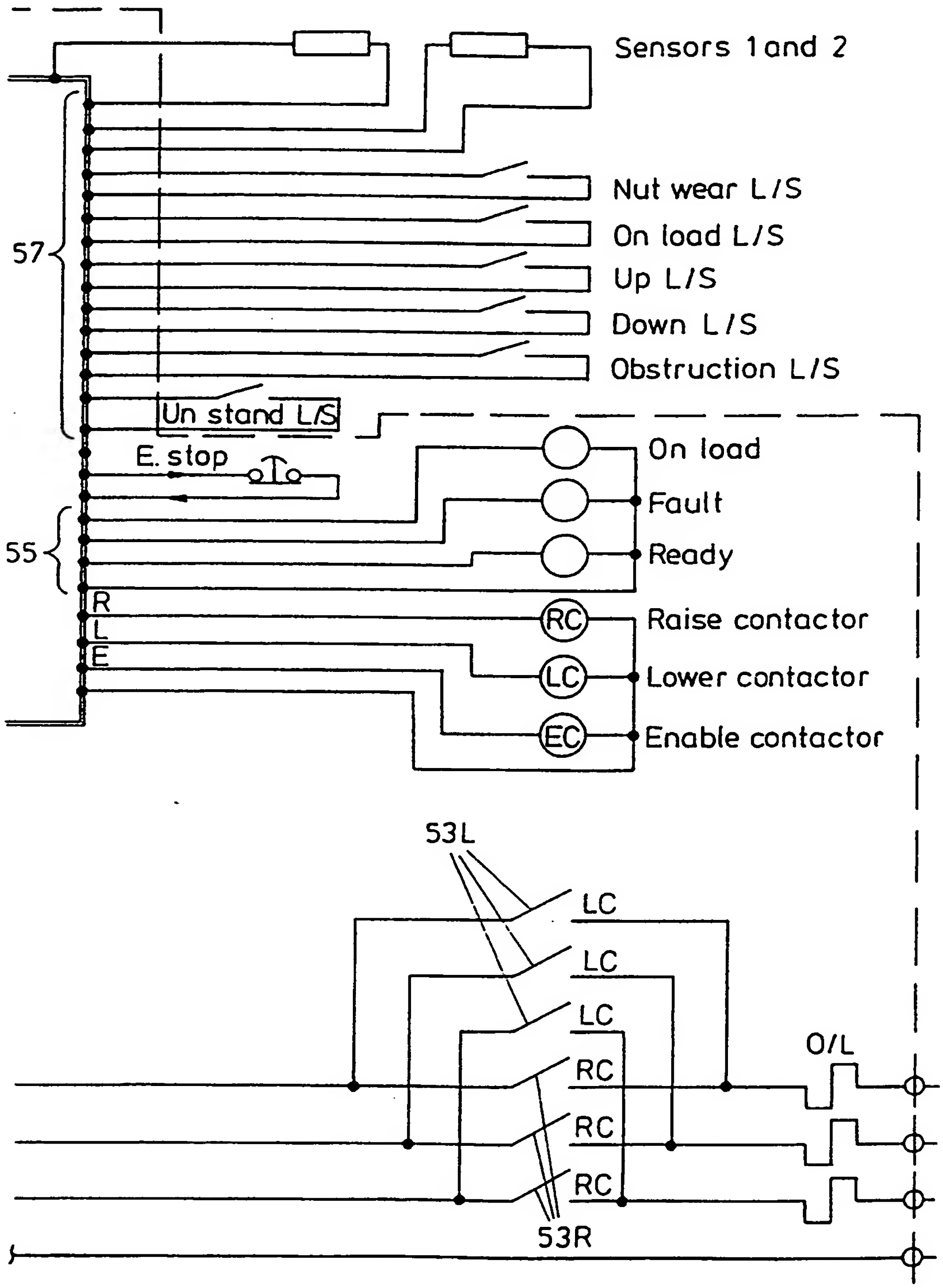
Sensors 1and 2
Nut wear L/S
On load L/S
Up L/S
Down L/S
Obstruction L/S
57
Un stand L/S
E. stop
On load
Fault
Ready
55
R
L
E
RC
Raise contactor
LC
Lower contactor
EC
Enable contactor
53L
LC
LC
LC
RC
RC
RC
O/L
53R

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/00002

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q9/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q G08C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	GB 2 310 519 A (MECHAN) 27 August 1997 see the whole document ---	1-36
X	EP 0 498 762 A (SOMFY) 12 August 1992 see column 1, line 1 - line 9 see column 1, line 52 - column 2, line 33 see column 3, line 12 - line 28 see column 3, last paragraph see column 5, line 18 - column 6, line 7 ---	1,4
A	GB 2 273 283 A (CALDICOTT ET AL.) 15 June 1994 see page 3, line 34 - page 4, line 14 see page 4, line 33 - page 5, line 3 see page 5, line 33 - line 36 see page 6, line 18 - page 7, line 6 see page 9, line 16 - line 31 see page 11, line 1 - line 5 --- -/--	1,2,6, 32,35

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 May 1998	20/05/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Holper, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/00002

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 127 600 A (MATSUSHITA) 11 April 1984 see abstract see page 2, line 51 - page 3, line 36 see page 4, line 1 - line 8 see page 4, line 67 - line 87 see page 7, line 2 - line 9 see page 9, line 23 - line 31 see page 9, line 90 - line 103 ---	1,3,33
A	GB 2 265 037 A (MOTORISED AIR) 15 September 1993 see page 1, line 26 - line 33 ---	2,32
A	LUGER S ET AL: "BELEUCHTUNG WIRD BUSFAEHIG" ELEKTRONIK, vol. 41, no. 26, 22 December 1992, MUNCHEN (DE), pages 26-30, XP000327405 see page 28, right-hand column, line 13 - last line; figure 2 -----	1,3,33

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 98/00002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB 2273283 A	15-06-94	NONE	
GB 2127600 A	11-04-84	JP 1647975 C	13-03-92
		JP 3015879 B	04-03-91
		JP 59052992 A	27-03-84
		CA 1191225 A	30-07-85
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